Space Weather Technical Forecast

Issued on Sunday, 28 April 2024 at 00:19 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of M-flares and slight chance of X-flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity is currently Moderate, with a M3.0 flare at 27/2140 UTC from AR3654, along with an earlier M2 flare from the same region at 27/12235 UTC. There are currently nine sunspot regions on the visible disc. AR3654, west of centre disc continues to show further development in its trailer portion. It has also developed a delta spot, and has shown an increase in magnetic flux in recent hours. AR3658 in the southwest has shown some minor development, with a few small intermediate spots emerging. AR3660, near the east limb, is difficult to accurately assess at present due to foreshortening, but looks to be a small bipolar group. Remaining sunspot regions are all relatively small, simple and stable, or showing slight decay.

A CME was observed starting around 26/1830 UTC, which emerged from an area of plage in the southeast of the disc, and was likely also associated with a filament eruption. The resulting CME is mostly passing behind and below Earth's orbit, but there is a slight chance of a glancing blow early on day 3 (30 Apr).

Solar Wind / Geomagnetic Activity: Solar winds observed by ACE at L1 have shown the onset of a HSS, perhaps combined with some weak CME influence. Wind speeds started at background levels but rose to become elevated approaching midday UTC, from around 330 km/s to near 500 km/s. Thereafter, wind speeds reduced erratically, 400-450km/s. Density has been average or below. The Interplanetary Magnetic Field has been mostly Moderate, but with some brief Strong peaks around 17nT between 27/0400-0630 UTC. However, in recent hours it has become weak, 5-6 nT. The north-south component, Bz, showed alternating periods of moderately negative and positive, peaks +14 nT and -9 nT. Phi angle was mostly positive (away from the Sun) with some brief negative (toward the Sun) periods. Geomagnetic activity was Quiet to Unsettled (Kp 1 to 3).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES18 was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was at background to moderate levels. The associated 24-hour fluence showed an initial drop but was then mostly steady, and was well below the Active threshold, with 1.72e6 integrated pfu observed at 28/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of M-flares and a slight chance of X-flares, this mainly from AR3654.

Solar Wind / Geomagnetic Activity: A CME which originated late on 26 Apr from an area of plage and a filament eruption in the southeast of the disc, could give a glancing blow early on day 3 (30 Apr).

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Met Office Space Weather Technical Forecast

Recent coronal hole HSS influence from CH27/+ has weakened during the second half of the 27 Apr. However, further weak coronal hole influences from CH30/+ and CH29/+ are possible in the next few days, although these lie progressively further to the south. Later on day 4 (1 May) a more likely connection comes from the narrow trans-equatorial coronal hole 31/-, which could become geoffective. This is a recurrent feature which gave Unsettled geomagnetic conditions on the last rotation.

Geomagnetic activity is expected to be Quiet to Unsettled for much of the period, but with a slight chance of Active to G1/Minor Storm intervals, mainly on days 1, 3 and 4 due to coronal hole or possible glancing CME influences.

Energetic Particles / Solar Radiation: High energy proton flux is likely to remain at background levels, but with a decreasing slight chance of reaching the S1/Minor Radiation Storm threshold, as the sunspot cluster which was in the southwest rotates well away from the limb.
High energy electron flux could perhaps increase slightly in the next couple of days as CME and HSS influences wane. However, fairly high confidence that fluence will remain well below the Active (1e8 integrated pfu) threshold.

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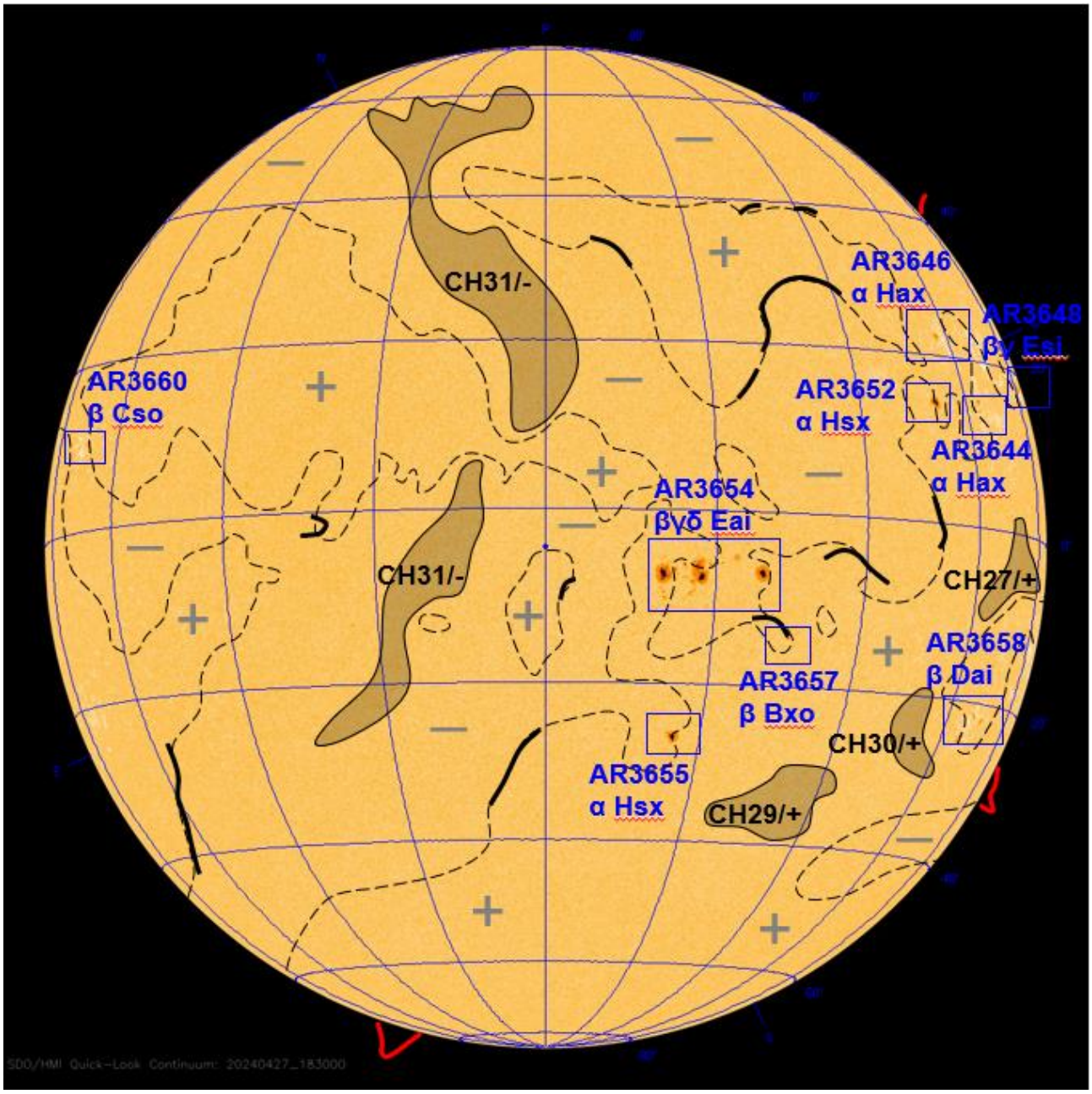
Figure 1. Solar Analysis Valid 27/1900 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There have been numerous CMEs released in the past week or so, mainly from ex-AR3638, which have likely mostly passed by Earth, although at least one such CME has arrived in the last couple of days. However, it is not possible to ascribe this to any one outstanding event, but there is a declining risk of further arrivals from this source as it has now rotated over the west limb. There is, however, a new CME which starting around 26/1830 UTC emerged from an area of plage in the southeast of the disc, and was likely also associated with a filament eruption. The resulting CME is mostly passing behind and below Earth's orbit, but there is a slight chance of a peripheral glancing blow on day 3 (30 Apr).

Recent coronal hole HSS influence from CH27/+ has weakened during the second half of the 27 Apr. However, further weak coronal hole influences from CH30/+ and CH29/+ are possible in the next few days, although these lie progressively further to the south. Later on day 4 (1 May) a more likely connection comes from the narrow trans-equatorial coronal hole 31/-, which could become geoffective. This is a recurrent feature which gave Unsettled geomagnetic conditions on the last rotation.

Geomagnetic activity is expected to be Quiet to Unsettled for much of the period, but with a slight chance of Active to G1/Minor Storm intervals, mainly on days 1, 3 and 4 due to coronal hole or possible glancing CME influences.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	5	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
27/0402	Partial	Filament	SE	472 km/s	30/1200 UTC	Glancing blow possible

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Radio Blackouts - X-Ray Flares:

There are currently nine sunspot regions on the visible disc. AR3654, west of centre disc continues to show further development in its trailer portion. It has also developed a delta spot, and has shown an increase in magnetic flux in recent hours. AR3658 in the southwest has shown some minor development, with a few small intermediate spots emerging. AR3660, near the east limb, is difficult to accurately assess at present due to foreshortening, but looks to be a small bipolar group. Remaining sunspot regions are all relatively small, simple and stable, or showing slight decay.

Far-side helioseismographs show a relatively large signal covering a large portion of the far-sided eastern hemisphere, although there is relatively little expected in this location from persistence. This remains something to be monitored for any increase later in the period, however for now no significant regions are expected. Overall, there is a chance of further M-flares and a slight chance of X-flares, this mainly from AR3654.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	50	50	50	50
Very Active	R3 to R5 X Class	No	10	10	10	10

Solar Radiation Storms - (High Energy Protons):

High energy proton flux (greater than 10MeV) observed at GOES18 has been at background levels, and is most likely to remain that way through this period. However, the cluster of spots which has now rotated over the southwestern limb still has the potential to cause an increase in proton flux until it reaches around 120W, late on Day 1 (28 Apr).

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	10	5	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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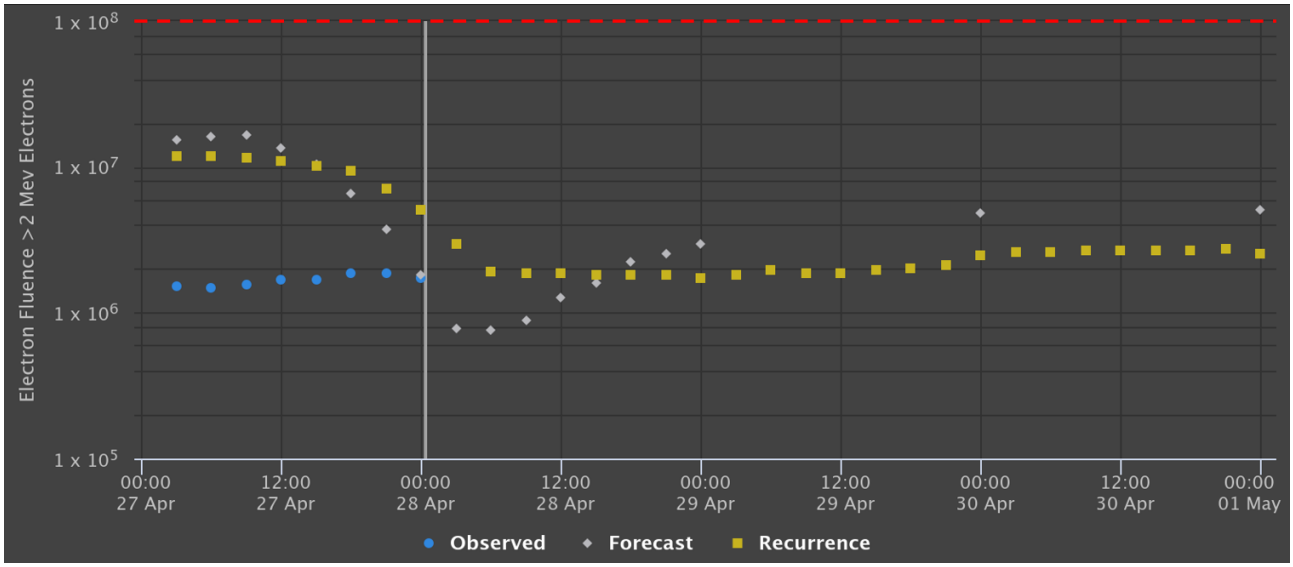
High Energy Electrons Event (≥ 2MeV):
High energy electron flux has been at background to moderate levels. There may be a slight rising trend in flux levels in the next couple of days, as recent and any lingering coronal hole HSS influences are expected to either remain weak or slowly wane. However, later on day 4 (1 May) CH31/- may become geoeffective, and there is also a low chance of peripheral CME glances early on day 1 (28 Apr) and perhaps on day 3 (30 Apr). Either of these features would tend to reduce electron counts if giving geomagnetic enhancement.

The 24 hour integrated electron fluence is most likely to remain well below the Active (1e8 integrated pfu) threshold, but perhaps with a slight rising trend as mentioned above. MOSWOC REFM is currently forecasting fluence to remain well below the Active level, and appears good guidance at present.

GEO Electron Environment	Level ($cm^{-2}\,sr^{-1}\,day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	5	5	5
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	10

Figure 2: Latest MOSWOC REFM output.



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